INTERNAL FIXATION OF UNSTABLE INTERTROCHANTERIC FRACTURES WITH SLIDING HIP SCREW AND PROXIMAL FEMORAL LOCKING COMPRESSION PLATE - A SHORT TERM PROSPECTIVE AND COMPARATIVE STUDY

Dissertation submitted for

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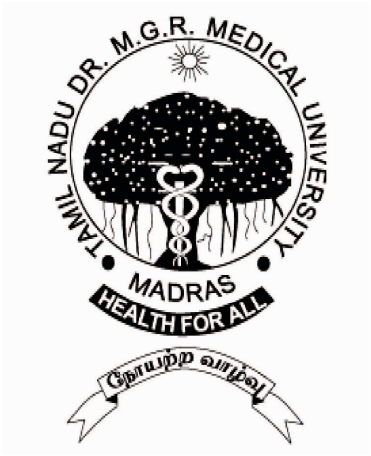
CHENNAI –3



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CERTIFICATE

This is to certify that this dissertation in **"INTERNAL FIXATION OF UNSTABLE INTERTROCHANTERIC FRACTURES WITH SLIDING HIP SCREW AND PROXIMAL LOCKING COMPRESSION PLATE – A SHORT TERM PROSPECTIVE AND COMPARATIVE STUDY"** is a bonafide work done by **Dr . C. PALANIKUMAR u**nder my guidance during the period 2010 – 2013. This has been submitted in partial fulfilment of the award of **M.S.** Degree in **Orthopaedics Surgery (Branch – II)** by The Tamilnadu Dr. M.G.R. Medical University, Chennai.

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DECLARATION

I, **Dr. C.PALANIKUMAR,** solemnly declare that the dissertation titled **"INTERNAL FIXATION OF UNSTABLE INTERTROCHANTERIC FRACTURES WITH SLIDING HIP SCREW AND PROXIMAL FEMORAL LOCKING COMPRESSION PLATE – A SHORT TERM PROSPECTIVE AND COMPARATIVE STUDY"** was done by me at The Rajiv Gandhi Government General Hospital, Chennai – 3, during 2010-2013 under the guidance of my unit chief **Prof.N.DEEN MOHAMED ISMAIL, M.S(Ortho), D. Ortho.**

The dissertation is submitted in partial fulfilment of requirement for the award of M.S. Degree (Branch – II) in Orthopaedic Surgery to **THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY.**

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CONTENTS

INTRODUCTION

Hip fractures are the second most common cause for hospitalisation elderly patients. Several epidemiological studies have shown that the incidence of proximal femoral fractures are increasing which is not unexpected because General life expectancy and associated osteopenia of population increased significantly during the past few decades .This number is expected to double by year 2050.The cause of Injury is simple fall in elderly individuals and high energy trauma in case of younger individuals[3].

Now the two broad categories[1] of internal fixation devices are used for fixation of inter trochanteric fractures. 1. Extramedullary(SHS,DCS,Angled blade plate),2.Intra medullary (Cephalo-medullary nails).But the preferred type device in unstable intertrochanteric fracture is controversial[1]. So still there is a series of evaluation in search of a perfectimplant. Role of SHS in unstable intertrochanteric fracture is having complication rate as high as 4-20% such as screw cut out and varus collapse of the proximal fragment.

The intra medullary devices having theoretical advantages[1] of stable anatomical fixation, lesser exposure, and less blood loss, But it needs prior anatomical reduction, which is very difficult in unstable intertrochanteric fracture. Precise entry point and more radiation exposure are technical complications in addition to varus collapse of proximal fragment.Now the

newer PFLCP have been proven to be efficient and comparable to other instruments in the treatment of intertrochanteric fractures.

AIM OF THE STUDY

To prospectively compare the functional outcome of unstable intertrochanteric fractures treated with Sliding Hip Screw and PFLCP.

REVIEW OF LITERATURE

HISTORICAL PERSPECTVE

Intertrochanteric fracture recognised first by Ashley cooper as a fractures in proximal femur distal to the insertion of capsule. Till 1940 closed reduction or immobilisation in plaster spica after closed reduction of the fracture is the standard treatment. Now the closed methods of treatment have largely been abandoned[1].

EVOLUTION OF TREATMENT

1822 –Cooper was the first to distinguish fracture neck of femur and intertrochanteric fracture.

1878 – Langeneck and Koenig first performed open reduction and internal fixation using a nail for fixation of hip fractures.

1881 – Senn was the first one to publish on the usage of screw for internal fixation.1900 – David used wood screw.

1902 – Royal Whiteman first reported closedreduction of fracture inabduction, internal rotation,and traction under anaesthesia.

1925 – Smith – Peterson reported the usage of triflanged nailing for intracapsular fracture.

1927-wolter [3]

1931-Reihold - described the idea of angular stability[3]

1937- Thronton devised plate attachment for the triflanged nail.

1932 – Johansson introduced a cannulated triflanged nail for intracapsular fracture.

1932 – Johansson introduced a cannulated triflanged nail

1941 –Jewett pioneered a one-piece implant by adding a solid plate to the triflanged cannulated nail.

1944 – Austin – Moore introduced a blade- plate, also advocated the use of Multiple pins which prevent rotations and support proximal fragment in all quadrants.

1947 – Mc Laughlin designed a variable angled nail plate which was strong and did not require bending of the plate to change the angle when attaching to the Smith - Peterson nail.

1955 – Schumpelick and Jantzan described about sliding screw, the design of which attributed to Ernest Pohl.

1964 – Clawson reported the use of a sliding screw and plate. The device was manufactured independently by Richard's manufacturing co.

1967 – Zickel described a Y shaped device which combined on intramedullarynail.

1970 - Group of polish surgeons had developed a locked plating system with Conventional plate and screws.[3]

1974 – Tronzo reported about using a Matchett – Brown endoprosthesis in the primary treatment of unstable intertrochanteric fractures.

1977 – Stern and Goldstein reported use of Leinbach prosthesis in the primarytreatment of unstable intertrochanteric fractures.

1978 – Ender described a method of passing flexing nails retrograde into the neck.

1980- Tepic &Perren –reported a locking plate principle for fracture fixation[3].

- Harris described closed condylo-cephalic nailing.

- Gamma nail was introduced in the same year.

1981 – Pho R reported the use of Thomson prosthesis in the primary treatment of unstable intertrochanteric fractures in the elderly.

1997 – Second generation trochanteric gamma nail was introduced[5].

2004 – James P.Waddel reported the role of total hip replacement for the treatment of unstable intertrochanteric fractures.

ETIOLOGICAL FACTORS

There are many factors influence the incidence of trochanteric fractures.

AGE:

The bodily changes occurring with aging, like inadequate protective reflexes[3], osteopenia, and inadequate local shock absorbers (muscle, fat around the hip[3]) are responsiblefor increasing the chances of fracture such an extent that even a trivial fall will result in fracture.

SEX:

All studies have shown female preponderance of hip fractures. The relative proportion varies from 1.7:1 to 4.5:1. Even thoughthere is not much difference in the male to female ratio before the age of 50, in more elderly patients there is a definite greater proportion of females in the later age group.

SEDENTARY LIFE STYLE:

All studies reported that incidence of fractures has increased in urban population compared to that of rural population. This is attributed to the sedentary life style in the urban areas leading to more rapid rate of age related bone loss. This is likely to increase in the following years.

RACE:

The highest incidence is seen in those of Caucasian population.

MEDICATIONS:

Corticosteroids reduce the bone strength if used for long – term treatment.

Hyperthyroidism increases bone turnover and may cause osteoporosis.

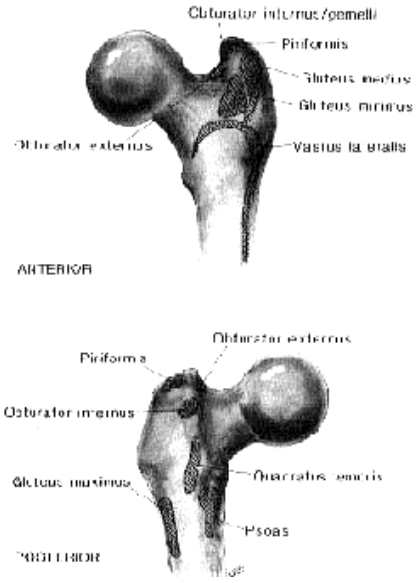
Sedatives at night where found to be associated with increased falls at night which will result in hip fractures.

Calcium, and Vit - D deficiencies are other causes producing osteopenia, and muscle weakness related fall leading to hip fractures.

ANATOMY

The proximal femur includes head, neck, lesser and greater trochanters, and proximal diaphysis. Although extremely variable, the adult neck-shaft angle averages 125degrees (106-155deg).Usually, femoral head centre lies one Diameter medial to, and level with tip of greater trochanter.

The classic intertrochanteric fracture femur occurs in a line between greater trochanter and lesser trochanter.



Anatomy of proximal femur with muscle attachment(anterior&posterior surface)[8]

Greater trochanter provides attachment for most of the gluteal muscles. Gluteus minimus is inserted into the rough impression on the anterior surface of greater trochanter .Gluteus medius is inserted into the oblique flattened strip which runs downwards and forwards across the lateral surface of greater

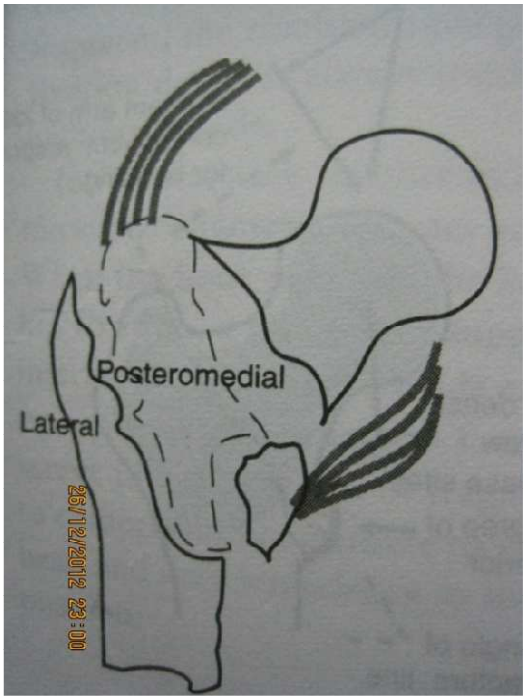
trochanter. At its point of insertion the gluteus medius is covered on its lateral surface by gluteus maximus. There is a bursa between the greater trochanter and the gluteus Maximus. Upper border of the trochanter gives insertion to piriformis,and its medial surface to common tendon of obturator Internus and gamelli.

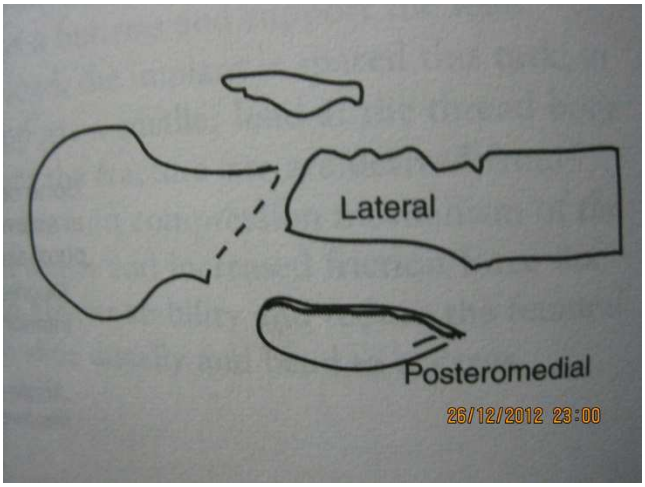
The lesser trochanter has the attachment of psoas major at its tip and medial part of the anterior surface. Illiacus is attached to the medial or anterior surface of its base and extend behind spiral line.

FRACTURE ANATOMY[2]:

A study of the anatomic patterns of these fracture parts will aid in avoiding surgical mistakes. The main fracture fragments of an unstable inter trochanteric fractures come from the

1. Proximal neck
2. Greater trochanter
3. Lesser trochanter
4. Proximal femoral shaft





Four major fragments of unstable inter trochanteric fractures[2]

The resulting bone deficiency includes large posterior and posterio-medial defects. What remains of the greater trochanter area is a fragile lateral wall that continues from the proximal femoral shaft. A fracture of the fragile lateral wall converts inter trochanteric fracture into a sub-trochanteric like fracture which is more unstable, therefore should be prevented.

The lateral wall is also important in providing a lateral buttress for proximal fragment compression, facilitating rotational and varus stability after fracture impaction and fracture spike interdigitation. If the lateral wall is broken, there is no lateral buttress for the proximal neck fragment: a collapse thus follows. An intact lateral wall plays a key role in unstable inter trochanteric fracture stabilization and fixation.

BIOMECHANICS

BIOMECHANICS AND PRINCIPLE OF LOCKING COMPRESSION PLATE:

The goal of treatment is achieving good anatomical reduction and stable fracture fixation to allow early ambulation.

Conventional compression plate fixation pioneered by Danis & AO group[3] using technique of absolute stability leading to direct bone healing is now challenged by less invasive procedure called “biological methods” of fracture fixation.

To accomplish perfect anatomical reduction, bone fragments were handled extremely in conventional plate fixation. Wide exposure of the bone was needed to gain access and for adequate visibility of the fracture zone to aid in reduction and plate fixation. The screw had to be tightened to compress and fix the plate onto the bone and it should be precontoured to match the anatomy of the bone. The stability of the fixation is achieved byFriction between the plate under surface and the bone, and also by bicortical hold of the screw.

Friction transfers load tangentially between plate under surface and the bone; the screws of the conventional plate are subjected to bending load. Bone avascularity and necrosis, noted as porosis under the plate on theearly post-operative x-rays, and is seen in the case of conventional plate fixation due to tight compression and excessive tissue handling. According to Wolff's law this bone loss is explained as mechanical unloading of platedsegment (stress protection[2]).

So conventional plates are inadequate in

- Achieving fixation in osteopenic or pathologic bone.
- Causes necrosis induced bone loss, which is nidus for infection.
- Due to stress shielding, there is a chance of refracture after implant exit.

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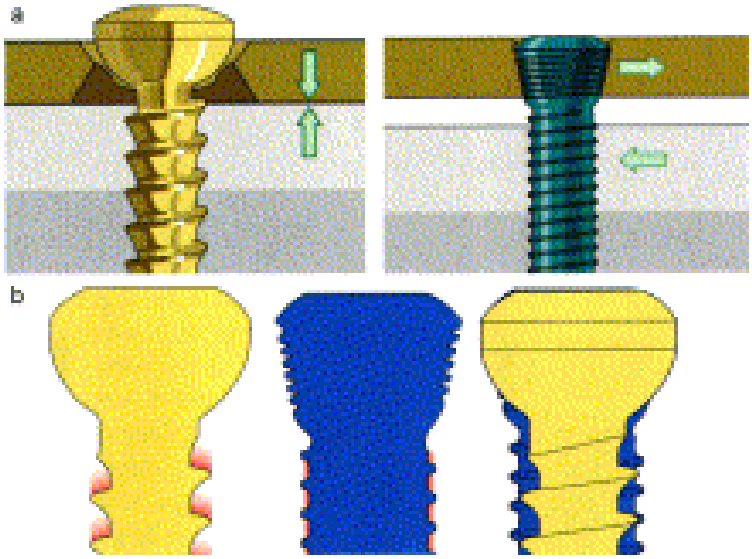


A. Representation of conventional and lockingscrews B. The diameter of locking screw is greater and its thread finer[19]

The most recent development in plate osteosynthesis is the locking plate. Here the priorities changed from mechanical stability to biology and better we can call it as a" Bio-buttress fixation or Biological internal fixation"[2]. Relative stability and secondary bone healing are the goals of this biological fixation technique.

The key change is the coupling between the screw head and the plate which results in some unique biomechanical properties. The locking compression plate can be applied to function like any other plate i.e it can provide compression, protection and bridging.

Conically threaded under surfaces of the screw heads fit matching threads in the plate, allowing the screws to effectively bolt into the plate .This angular- stability has significant biomechanical implications, they are

Conventional and locking screws showing Toggling and Angular stability respectively

1. The construction does not require to be compressed to the bone for stability. So there is no contact with periosteum, this provides relative Stability and maximises the possible periosteal blood supply to allow rapid, indirect healing through callus formation.

2. The strength of fixation equals the sum of all screw – bone interfaces rather than that of single screws axial stiffness or pull-out resistance as seen in the conventional plates.

3. Screw-plate locking act as a surrogate cortex[2] sometimes precluding the need for bicortical screw. This allows the insertion of monocortical locking screws through percutaneous aiming arms without precise measurement of screw length.

4. It prevents secondary displacement and collapse of fixation.

5. There is no need for precise contouring, as plate is not compressed against bone.

6. As a single-beam[2] construct, it enhances fracture fixation in conditions where fracture configuration or bone quality does not provide sufficient screw purchase to achieve the plate bone compression to minimise the gap strain.

7. Achieving good purchase in opposite cortex is not needed in locking screws because there is no pull-out force and slightly shorter screw is better

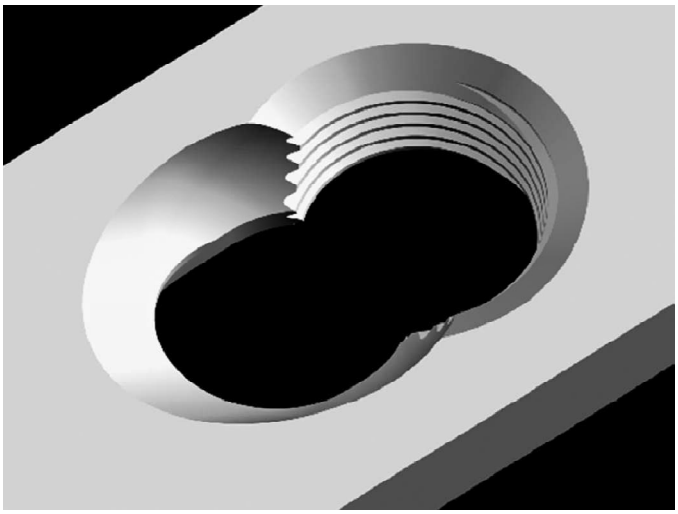
than an overly long screw. However the type of fracture should be taken into account to select a screw length in situations like small fragment at the fracture site.

8.A locked plate- screw construct can be thought of similar to an “implanted external fixator”[2] with minimal soft tissue dissection, wide screw spacing, locked screws, and the plate as a connecting bar as close as possible to the bone/mechanical axis. This new technology is closely related to the concept of “Pure splinting” than that of conventional fixation.

9. Locked plate doesn’t rely on frictional force between the bone interface to achieve compression and stability. So the blood supply to the periosteum is preserved that allows rapid bone healing.

Maintained blood supply reduces the infection rate, secondary loss of reduction, delayed and non-union, and bone resorption.

10.A further advantage in locked compression plate is combination of conventional self-compressing unit hole and threaded locked internal fixator hole. A plate with combined hole provides dynamic compression by eccentric screw placement and lagging to achieve maximal interface compression. The threaded plate hole offer angular stability, better anchorage, eliminate toggling, and reduce the loss of reduction.



Combi-hole in LCP[4]

Ideal plate length can be determined by plate span width and the plate-screw density[3]. The plate span width[3] is a quotient of plate length divided by overall fracture length and this quotient should be more than 2-3 for comminuted fractures and higher than 8 for simple fractures. The minimum number of screws per major fragment in locked plate is debatable. Two screws per main fragment with at least three cortices for simple fracture and for comminuted fractures, two screws per main fragment with at least four cortical purchases is a sound practice to follow. When in doubt, better to have bicortical purchase as in the case of metaphyseal bone with a minimal cortex. Otherwise in a scientific point of view according to (Gautier's[3])plate-screw density index a value of 0.5 for diaphysis, 0 for fracture zone, and is 0.75 for metaphysio-epiphyseal region[4].

RECENT CONCEPTS IN LOCKING PLATE:

Variable-angle locking[6]

Implicitly accepted as being able to adapt to different fracture types to provide fixation for a particular fragment especially in epiphyseal region. The results of in vitro mechanical tests by manufacturers are good,more clinical studies are needed to confirm it.

Far Cortical Locking[6] (FCL):

This concept has gained attention recently in which far cortex but not the near cortex is engaged by the screw either by over drilling the near cortex or by screw design which engages only the far cortex.It was found to be 88% stiffness reduction than the locking construct with 36% more callus formation and 54% stronger when tested to failure. -

APPLICATION OF LCP

"LAG FIRST, LOCK SECOND"[2] once a locking head screw has been inserted in a bone segment,no conventional screws should be added in the same segment ,as this create unwanted tension forces within the plate and bone.

A reduction screw may be used to approximate a fragment to the locked plate as indirect reduction tool and then locking screws are added to keep the fragment inplace to the plate.

PROXIMAL FEMUR LOCKING COMPRESSION PLATE:

The LCP proximal femur plate is a low contact stainless steel hybrid plate with a combination of conventional non-locked screws (to use plate as template for reduction)and locked screws(for advantages of fixed angle support of end segment fractures and improved fixation in osteoporotic bone.

- the proximal portion of the plate is precontoured anatomically for lateral aspect of the proximal femur.

Plates specifically designed for left or right femur to accommodate average femoral neck anteversion.

Plate lengths allow spanning of the entire diaphysis in segmental fracture patterns.

Use of locking screws provides the option of an angular stable construct independent of bone quality.

Plate can be tensioned to create a load- sharing construct

The three proximal screw holes are at the following angles to the plate shaft:

First proximal hole(7.3mm): 95deg

Second proximal hole(7.3mm):120deg

Third proximal hole(5mm):135deg

AO-ASIF PRINCIPLES[20]:

Anatomic reduction:

Anatomic plate profile assists reduction of metaphysis to diaphysis and facilitates restoration of the neck –shaft angle by proper screw placement.

Stable fixation:

The combination of conventional and locking plate fixation offers optimum fixation irrespective of bone density.

Preservation of blood supply:

A limited – contact design reduces plate to bone contact and helps to preserve the periosteal blood supply.

Early mobilisation:

Plate features combined with AO technique create an environment for bone healing, expediting return to function.

INDICATIONS:

1.Fractures of the trochanteric region, trochanteric simple, cervicotrochanteric, trochantero-diaphyseal, multifragmentary per trochanteric, intertrochanteric, trochanteric reversed or transverse or with additional fracture of medial cortex.

2. Fractures of the proximal end of the femur combined with ipsilateral shaft fractures.

3. Metastatic fractures of the proximal femur

4. Osteotomies of the proximal femur

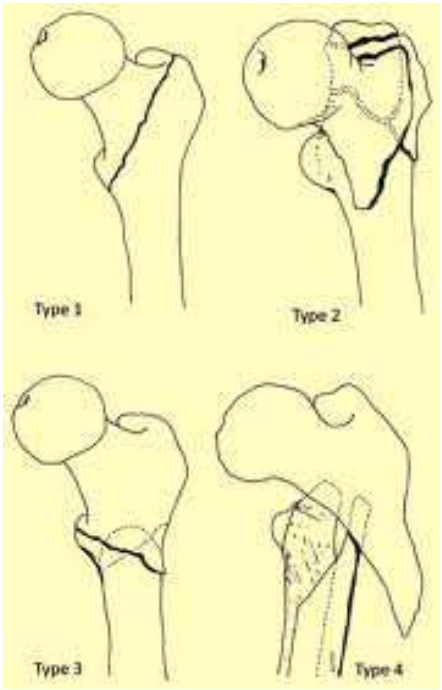
5.Also for use in fixation of osteopenic bone and fixation of non-unions or mal-unions.

CLASSIFICATION AND ASSESSMENT

There are many classification to assess and understand the intertrochantric fractures of femur. These are put forth for better pre operative planning of treatment and to prognosticate.

BOYD H.P AND GRIFFIN L.[1,21]This include all fractures from extracapsular neck to a point, 5cm distal to lesser trochanter.

Type I Fracture extending along the intertrochanteric line from greater trochanter to lesser trochanter. Reduction of this type of fracture is usually simple and is maintained with little difficulty. Results are generally satisfactory.



Type II - Comminuted fractures, the main fracture being along intertrochanteric line but with multiple fractures in the cortex.Redution of these fractures is more difficult as the comminution may vary from slight to extreme.

Type III - Fractures that are basically subtrochanteric with at least one fracture line passing across the proximal fragment i.e part including greater trochanter and lesser trochanter. Varying degrees of comminution associated. These are more difficult to reduce and result in more complications both at operation and during convalescence.

Type IV - Fractures of the trochanteric region and the proximal shaft,with fractures in at least two planes. During internal fixation two plane fixation is required because of the spiral oblique butterfly fragment of the shaft.

JENSEN AND MICHAELSON CLASSIFICATION[21]

STABLE

TYPE I undisplaced – 2 part fracture

TYPE II Displaced - 2 part fracture

UNSTABLE

TYPE III - Three part where greater trochanter is 3rd part, loss of medial support.

TYPE IV - Three part fracture where lesser trochanter is the 3rd part ,loss of medial support.

TYPE V - Four part fracture involves both lesser and greater trochanter loss of medial and postero lateral support.

EVAN'S CLASSIFICATION [1,3]

He divided the fractures into stable and unstable types. Unstable types further divided into those in which stability could be restored by anatomical or near anatomical reduction and those in which stability could not be restored.

Type I - The fracture line extends upward and from the lesser trochanter.

STABLE

GROUP I - Fracture in which inner cortical buttress has been undisturbed(65%) .

- no displacement
- fractures become stable

GROUP II Fracture in which there is overlapping of inner cortical buttress (7%).

- can be reduced by manipulation
- fractures become stable.

UNSTABLE

Group III This fractures includes those fractures in which the overlapping remains unreduced(14%)

- can not be reduced by manipulation
- unstable fracture
- coxa vara to be expected

Group IV This group includes comminuted fractures (6%)

- can not be reduced
- unstable fracture
- coxavara to be expected

TYPE II - The obliquity of the fracture line is reversed, in which fracture line extends outwards and downwards from the lesser trochanter. They have a tendency towards medial displacement of the femoral shaft because of adductor muscles.(8 %)

TRONZO'S CLASSIFICATION(1973)[21]

He classified the trochanteric fractures into 5 types.

TYPE I - Incomplete trochanteric fractures – anatomical reduction is achieved with traction.

TYPE II - Non comminuted fractures with or without displacement in which both trochanter are fractured. They are reduced with traction. Anatomic reduction is usually achieved.

TYPE III - Comminuted fractures in which lesser trochanter fragment is larger. The posterior wall is exploded, beak of inferior neck already displaced into medullary canal of the shaft fragment. These are so called unstable fractures. A variant of type III is also fracture and separation of greater trochanter.

TYPE IV - Comminuted trochanteric fractures with disengagement of two main fragments. Again these are unstable with posterior wall exploded with the spike of the neck fragments displaced outside of or medial to the shaft.

TYPE V - Trochanteric fractures with reverse obliquity. These are unstable.

KYLE, GUSTILO AND PREMIER CLASSIFICATION[21]

TYPE I - Fractures are stable, undisplaced intertrochanteric fracture.

TYPE II - Fractures are stable, displaced fractures with fracture lesser trochanter and varus deformity.

TYPE III - Fractures involve fracture of greater trochanter, poseromedial comminution with varus deformity.

TYPE IV - In addition to components of type III also have subtrochanteric component.

The AO classifiction[22]A1: simple (2- fragment) pertrochanteric fractures

A1.1 Fractures along the inter trochanteric line

A1.2 Fracture through the greater trochanter

A1.3 Fractures below the lesser trochanter

A2: Multitrochanteric pertrochanteric fractures

A 2.1 With one intermediate fragment(lesser trochanter detachment)

A2.2 With 2 intermediate fragments

A2.3With more than 2 fragments

A3:Inter trochanteric fractures

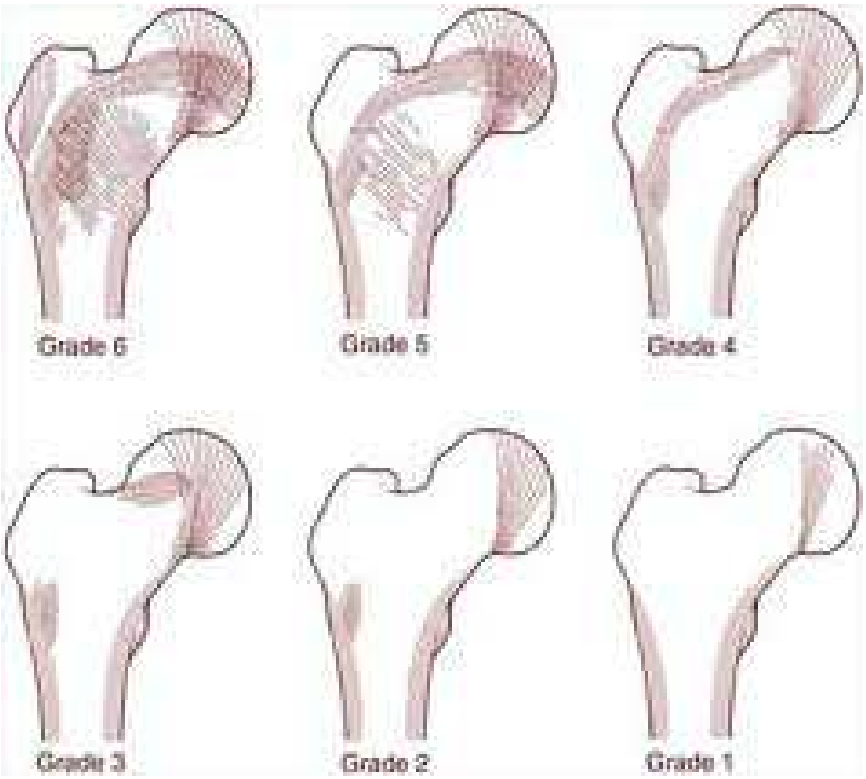
A3.1 Simple oblique

A3.2 Simple transverse

A.3 With a medial fragment

SINGH'S INDEX FOR ASSESSING OSTEOPOROSIS:

Is a method of assessing the severity of the osteoporosis and it is estimated by studying the trabeculae pattern within the proximal femur.



SINGH'S INDEX (GRADING OF OSTEOPOROSIS)[18]

Grade I – Even the principal compressive trabeculae within the head are reduced. Other trabeculae are absent.

Grade II – Most trabeculae are reduced other than those within the femoral head.

Grade II – There is a break in the continuity of the principal trabeculae opposite to the greater trochanter

Grade IV – Principle tensile trabeculae are markedly reduced but can still be traced from the lateral cortex to the upper part of the femoral neck.

Grade V – All trabeculae present but are less prominent and a triangle of radiolucency is apparent.

Grade VI – All the normal trabecular groups are visible and the upper end of the femur seem to be completely occupied by cancellous bone.

Grade III to I represent osteoporosis.

COMPLICATIONS OF FIXATION

FAILURE OF FIXATION

Failure of fixation can be defined as anyone of the following:

- cut-out of the implant from the femoral head. Refracture around the implant.
- separation of the two components of the implant
- Detachment of the plate from the femur.
- Breakage of the implant
- . no sign of union at the fracture even after one year.

CUT-OUT OF THE SCREW:

Cut-out of the screw is mainly because improper placement of screw in the head. Also it may occur due to gross osteoporotic bone and early weight bearing. The management is to remove the screw and reinsert in an undamaged section of the head or fixation using 90 or 95 deg dynamic condylar screw. Another option is replacement of the comminuted proximal femur by total hip arthroplasty.

DETACHMENT OF THE PLATE FROM THE FEMUR

This complication is very rare and it is managed by revision fixation in the fresh screw holes.

BREAKAGE OF THE IMPLANT

Breakage of the implant is extremely rare, which testifies the strength of current implants.

NON-UNION

Non-union may be considered as developed when the fixation device remains solid and there are no signs of radiological union at nine months from injury.

Management:

Expectant:

If the fixation device remains solid and the patient has minimal symptoms, expectant treatment may be used.

Revision of fixation:

If revision surgery is planned, the fracture must be fixed by supplementary bone grafting to the fracture site.

AVASCULAR NECROSIS

Avascular necrosis is a rare complication of an extracapsular fracture and tends to occur only in the intracapsular basal fracture. Rotation of the screw during the insertion of the screw may be responsible for damaging the blood supply to the femoral head and the subsequent avascular necrosis. The

fracture usually unite in the presence of avascular necrosis but best functional outcome is achieved by total hip replacement.

INFECTION

Causes may be due to excessivesoft tissue handling,condition of the operation room and the duration of the surgery. It is also dependent on the age and immune status of the patient. Infections are treated with thorough debridement and sensitive antibiotics.

VARUS DEFORMITY:

Improper pre-op reduction and early weight bearing are the reasons for the deformity. Usually it is associated with cutout of the implant.

MATERIALS AND METHODS

This study was conducted at Rajiv Gandhi Government General Hospital and Madras Medical College on 40 patients with unstable intertrochanteric fractures from June 2010 to October 2012 and they were treated respectively by PFLCP (n=20) and SHS (n=20).

INCLUSION CRITERIA

- Age more than 18 years
- Both genders
- Unstable intertrochanteric fracturesof Boyd and Griffin type II,III,IV

Exclusion criteria:

- Open fractures (Grade II,III)
- Pathological fractures
- Inability to walk prior to injury
- Patients with associated fractures of lower limb
- Patient unfit for surgery
- . Un co- operative patient for post-operative rehabilitation

EVALUATION OF THE PATIENT:

Thorough medical examination was done as the patients were usually elderly with age related medical problems.The lower limb on fracture side was shorter and in external rotation in intertrochanteric fracture than that seen with an intracapsular fracture because the ilio-psoas muscle externally rotates the femoral shaft, which is the reverse of anatomical situation. Local swelling, and bruises were present. Any movement of the extremity was painful hence it was not tried.

RADIOGRAPHIC EVALUATION:

Both antero-posterior and lateral radiographs were taken pre-operatively and studied.Image intensifying T.V. control with c-arm or x-ray was used to ensure pre-operative reduction and also for intraoperative guide wire and Proximal screws placement.

FUNCTIONAL ANALYSIS:

The functional outcome was evaluated using Harris-Hip score during follow up.

STATISTICAL ANALYSIS:

Data are reported as mean and significant difference between the two groups was studied using Yate's corrected Chi-Square test.

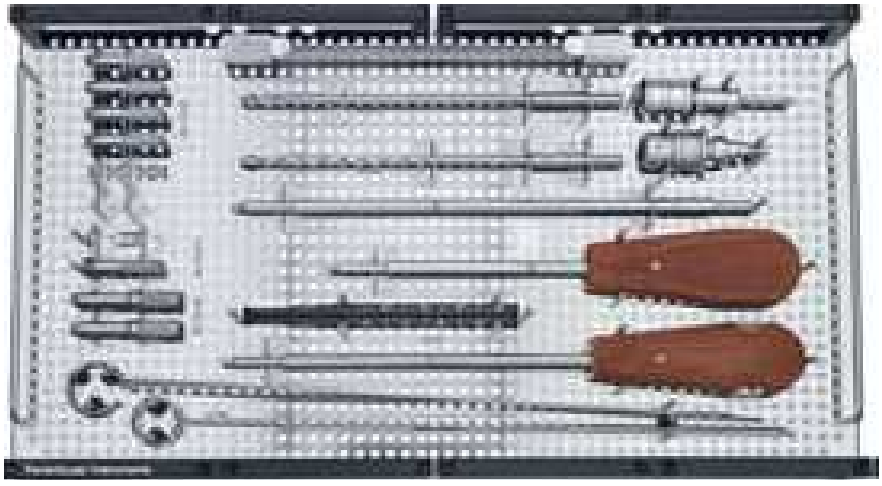
PFLCP INSTRUMENTATION[20]

1.Proximal two cannulated locking/ conical screw of 7.3mm size with fully threaded shaft and self- drilling, self-tapping tip. It is cannulated to permit guide wire along its axis. Length of the screw varies, and 65mm - 95mm screws used in our study with an insertion angle of 95deg and 120deg respectively.

2. Third proximal screw is a cannulated locking/conical of 5mm size with an insertion angle of 135 deg is used optionally if fracture pattern permits.

The self-drilling, self-tapping flutes of the 7.3mm and 5.0mm screws make pre drilling and pre tapping are unnecessary in most cases.

- 5mm drill bit used for 7.3mm screws
- 4.3 mm drill bit used for 5mm screws



Instrumentation tray[20]

3. Locking screw of 5mm size for the shaft of the plate, create a fixed angle Screw- plate.

4. Conventional cortical screw of 4.5mm size used in combi- holes which compress the plate to the shaft to achieve axial compression and this cortical screws must be inserted into the plate shaft before insertion of locking screws to the plate shaft.

5. Guide wires: They are 2mm for 5mm cannulated proximal screw and 2.5mm for 7.3mm cannulated proximal screws.

SURGICAL PROCEDURE:

Complete the preoperative radiographic assessment was done .AP and lateral radiographs of the entire femur are necessary for complete evaluation. Traction radiographs and views of the contralateral femur are useful adjuncts in the planning process.

When considering use of the LCP proximal femoral plate, identify the proper placement of the three proximal screws.

In the planning, x-ray templates were used. The plate length, approximate screw lengths and instruments to be used were predetermined. Patient positioned on fracture table and draped.

REDUCTION OF FRACTURE:

They are basically three types:

1)Anatomical reduction:

Medial cortex to cortex reduction

2).The Wayne county general hospital reduction

Here the proximal fragment is displaced medially. The calcar femorale remaining on the proximal fragment is impinged on the medial cortexof the distal fragment.

3).The Dimon - Hughston method

In which the intertrochanteric portion of the proximal fragment is embedded into the distal fragment. The femoral neck gets support by medial cortex of the shaft and base of the neck buttressed against lateral cortex.

In our study we did only anatomical reduction except for 4 cases of SHS where we did Dimon-Hughston method.

POSITON:

The anaesthetised patient was positioned on fracture table, taking care to avoid undue pressure or tension on any part of the body. The patient's buttocks were rested on well-padded seat with counter-traction post between

the lower limbs. The feet were tied to the foot pieces of the fracture table. Closed reduction of the fracture could be achieved by gentle traction and abduction in moderate external rotation followed by gentle but firm internal rotation. Traction was adjusted to obtain reduction in valgus but too much traction was avoided, as that might cause valgus over correction. The hip was abducted to only 15 to 20deg.Abduction beyond this could cause angulation at the fracture.

Reduction was checked by Antero-posterior and lateral view with image intensifier TV using C-arm or x-ray, special attention to cortical contact medially and posteriorly.

EXPOSURE:

A standard lateral approach to proximal femur was made both for PFLCP and SHS after the tip of the trochanter was palpated by the surgeon's index finger. After a longitudinal incision of the tensor fascialata,incisevastuslateralis at its proximal incision, and the muscle was flipped to visualise

A **B**

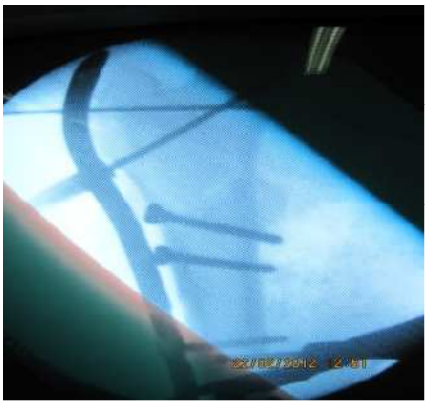
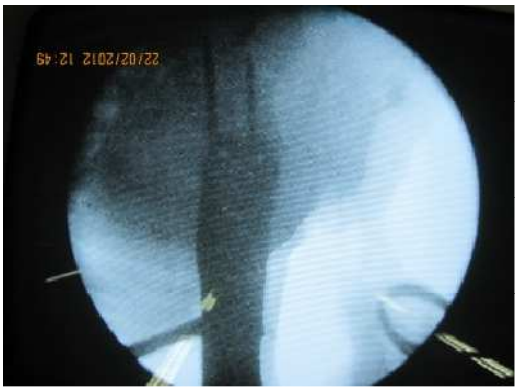
Intra operative pictures showingA. After Guide wire insertion B. After plate Fixation

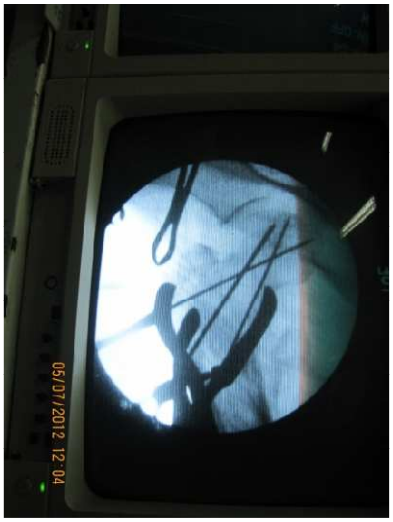
the lateral aspect of femur. The comminution zone of fracture is avoided. For complex and comminuted fractures, where close reduction not possible, we chose to open and achieved reduction. Fracture reduction was verified by fluoroscopy in AP and Lateral view x-rays.

INSERTION OF GUIDE WIRE:

When the fracture reduction was successfully done, a guide wire was passed along the anterior surface of the neck and head on their midpoints to assess the angle of the femoral ante- version. Prior placing the plate on the bone wire guides were threaded into the plate for each of the three proximal locking screws. Guide wires used as a manipulation aid for placing the plate on the femur. The plate was slid distally on the submuscular plane using a distal counter incision (proximal incision 6-7cm, distal incision 4cm) at the level of the tip of the plate. A 2.5mm guide wire was inserted through a drill sleeve threaded through proximal two holes. The guide wires were advanced to the subchondral bone of the femoral head. Their positions were confirmed by fluoroscopy in the antero- posterior and lateral views. At this point it is crucial to ensure that the distal plate was appropriately aligned to the femoral shaft.

Placement of tip of proximal guide wire in the AP view is into the inferomedial quadrant of the femoral head along path subtending 50 deg angle to the calcar femoris, which facilitate placement of the proximal locking screw at a 95 deg angle to the femoral shaft. The proximal wire is placed ideally posterior to the centre in lateral view. Accurate positioning of the proximal guide wire assures frontal plane alignment and it also accommodates anteverted position for thesecond guide wire and screw.



INTRA-OP FLUOROSCOPY PICTURES SHOWING GUIDE WIRE INSERTION

Before insertion of second guide wire, verify sagittal alignment of plate on the proximal femur. When this alignment is satisfactory insert the nexttwo guidewires. Third guide wire may be deferred until final reduction has been achieved. Using the measuring device, appropriate length 7.3mm cannulated screw selected and inserted with the screw driver under the fluoroscopy guidance. Secure the plate to the lateral shaft with bone holding forceps, adjust the rotational alignment as appropriate.Appropriate length plate was selected by plate span width and screw-platedensity (Gautier's index)[3]. Using drill guide and 3.2mm drill bit, all 4.5mm cortical screws were inserted prior to insertion of any locking screw in theplate shaft. When all the screw inserted and tightened a suction drainageinserted and the wound was closed in layers taking care to close the tensor fascia water tight.

After the surgery, drain was removed after 48 hours. All patients encouraged to start flexion and extension of the hip and knee at the affected side. Suture removal done on 12th post - operative day.Partial weight bearing started about 6 weeks after operation. Weight bearing was gradually increased to tolerance level.

Patients were called for first follow-up at 4-6 weeks and second follow-up was by 3rd month and third, fourth was 6th month and 1year respectively.

OBSERVATIONS

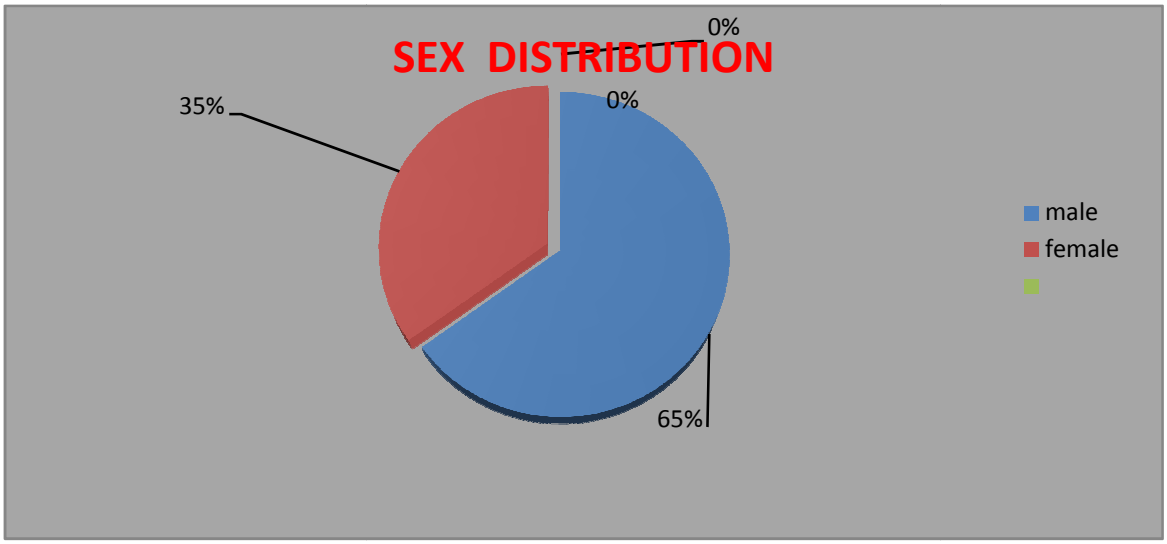
This study included 40 patients with unstable intertrochanteric fractures and 20 each of them were subjected to SHS and PFLCP treatment respectively by systematic random sampling.

The observations made in this study are:

There was a male (65%) preponderance.

COMPARISON OF BASE LINE INFORMATION BETWEEN TWO GROUPS

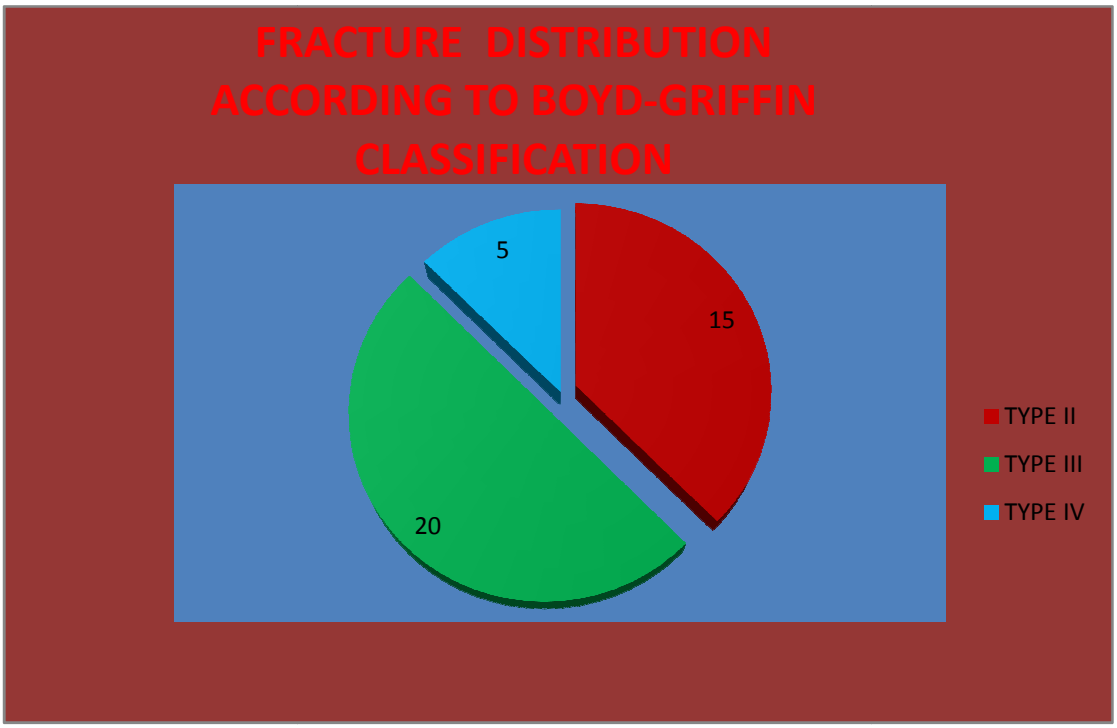
Group	Gender		Mean Age (Yrs)
	Male	Female	
LCP	14	6	46.3 (27-68)
SHS	12	8	58.75(34-75)
LCP: locking compression plate, SHS: Sliding Hip Screw			



In the distribution of fracture according to Boyd & Griffin classification,Type III(50%) was more common because most patients had low velocity injury.

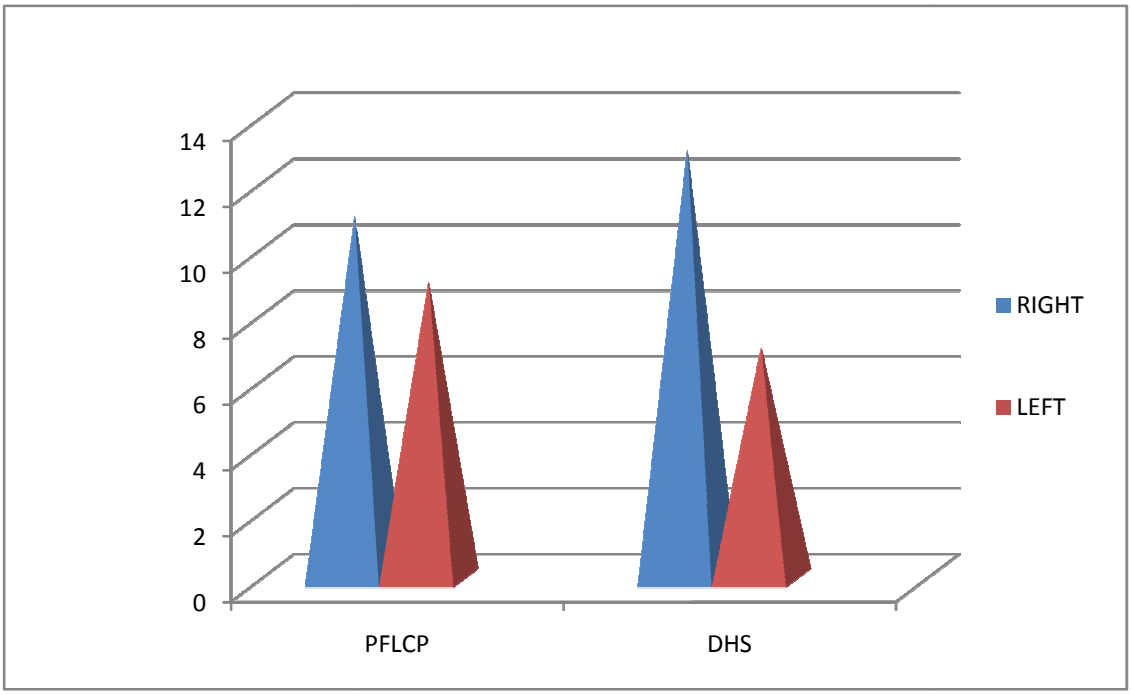
DISTRIBUTION OF FRACTURES ACCORDING TO BOYD AND GRIFFIN CLASSIFICATION

GROUP	BOYD AND GRIFFIN TYPING		
	II	III	IV
LCP	7	11	2
SHS	8	9	3



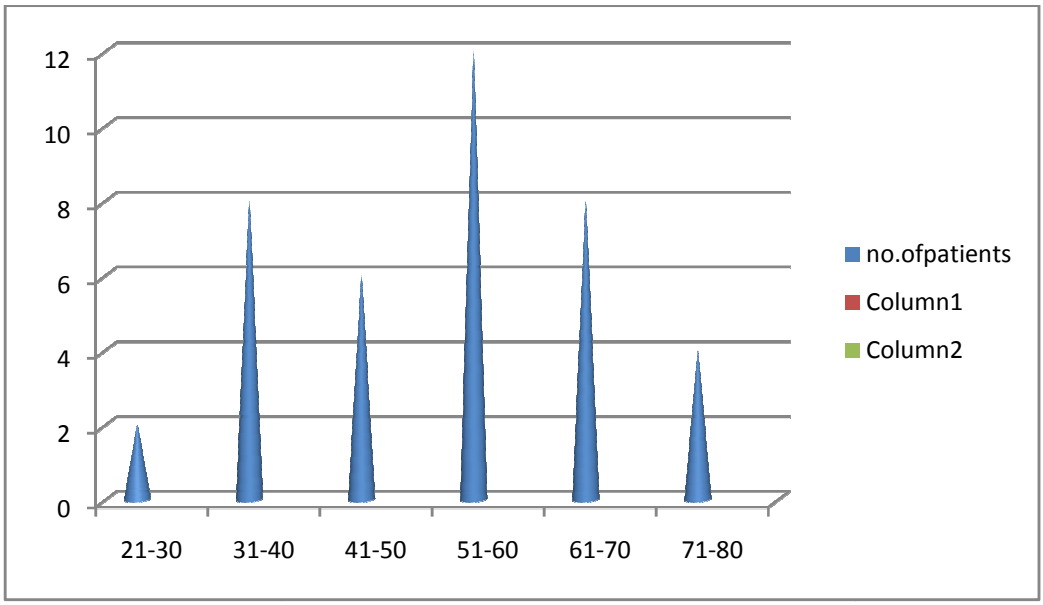
SIDE INVOLVED

GROUP	SIDE	
	RIGHT	LEFT
LCP	11	9
SHS	13	7



In most of our patients right side was commonly (60%) affected.

AGE GROUP	NO.OF PATIENTS
20-30	2
31-40	8
41-50	6
51-60	12
61-70	8
71-80	4



The patients maximum affected were in the age group of 51-60 years. There was only two cases in 20-30 age group. These findings confirm that these are essentially old age fractures.

COMPLICATIONS

The following complications were noted in our study

	PFLCP(18)	**%**	**SHS(16)**	**%**
Varus angulation	1	5.5%	2	12.5%
Screw cut-out	0	0	1	6.25%
Non-union	0	0	0	0
Breakage of implant	0	0	1	6.25%
Superficial infection	1	5.5%	2	12.5%
Deep infection	0	0	1	6.25%

Yate's corrected Chi-Square Test

X2 = 4.64

P = 0.03

Average no.of hospital days were 24.75. In most of the cases delay occurred due to the management of associated medical illness and to get anaesthesia fitness.

In our study except one case of varus angulation (5.5%) and one case of superficial infection (5.5%), no other complications were noted in PFLCP group.

In case of SHS, two patients developed superficial infection (12.5%) whichhealed on suture removal and a course of oral antibiotics. One patient developed deep infection (6.25%) which settled after wound debridement, secondary suturing, and a course of intravenous antibiotics. Two cases of varus angulation in type III&IV cases were managed by implant exit and PFN& Hemiarthroplasty respectively. A case of screw cut out in type IV fracture was managed by calcar replacing Hemiarthroplasty and a case of implant breakage in type III fracture was managed by implant exit and Dynamic condylar screw.

Amongst all 40 patients, 38(95%) were available for follow-up check-up at 6 weeks, 36(90%) at 3 months, 35(87.5%) at 6months, 34 (85%) at 1 year. Sixpatientswere lost to follow-up. Of the total patients, 27 were treated by closed reduction and others were chosen for open reduction. The average operation time was 85+-13min for PFLCP and 72+-14min for SHS. All the fractures healed well by 14 – 18 weeks.

RESULTS

This study was conducted at Madras Medical College and Rajiv Gandhi Govt.General Hospital on 40 unstable intertrochanteric fractures from May 2010 to October 2012 .In our study all the patients were evaluated clinicallyusing Harris - Hip Score at various follow-up period.

Based on the Harris Hip Score the results were graded as excellent, good, fair, and poor as follows:

Excellent : > 90 points

Good : 80-89 points

Fair : 70-79 points

Poor : < 70 points

MODIFIED HARRIS HIP SCORE

PAIN
- None or ignores it (44)
- Slight, occasional, no compromise in activities (40)
- Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (20)
- Marked pain, serious limitation of activities (10)
- Totally disabled, crippled, pain in bed, bed ridden (0)

LIMP
- None (11)
- Slight (8)
- Moderate (5)

Severe (0)

SUPPORT
- None (11)
- Cane for long walks (7)
- Cane most of the time (5)
- One crutch (3)
- Two canes (2)
- Two crutches (0)
- Not able to walk (0)

DISTANCE WALKED
- Unlimited (11)
- Six blocks (8)
- Two or three blocks (5)
- Indoors only (2)
- Bed and chair (0)

STAIRS
- Normally without using a railing (4)
- Normally using a railing (2)
- In any manner (1)
- Unable to do stairs (0)

BEND TO TOUCH THE ANKLE
- With ease (4)
- With difficulty (2)
- Unable (0)

SITTING:
- Comfortably in ordinary chair 1 hr (15)
- On a high chair for one – half hour (3)
- Unable to sit comfortable in any chair (0)

ENTER PUBLIC TRANSPORTATION
- Yes
- No

Flexion contracture (degrees)
Leg length discrepancy (degrees)

ABSENCE OF DEFORMITY (all yes = 4, less than 4 = 0)
- Less than 30* flexion contracture
- Less than 10* fixed adduction
- Less than 10* fixed internal rotation in extension
- Limb length discrepancy less than 3.2cm
-

RANGE OF MOTION(total degree then check range to obtainscore)
- Flexion (140*)
- Abduction (140*)
- Adduction (40*)
- External rotation (40*)
- Internal rotation (40*)

RANGE OF MOTION SCALE
- 211* - 300* (5)
- 161* - 210* (4)
- 101* - 160* (3)
- 61* - 100* (2)
- 31* - 60* (1)
- 0* - 30* (0)

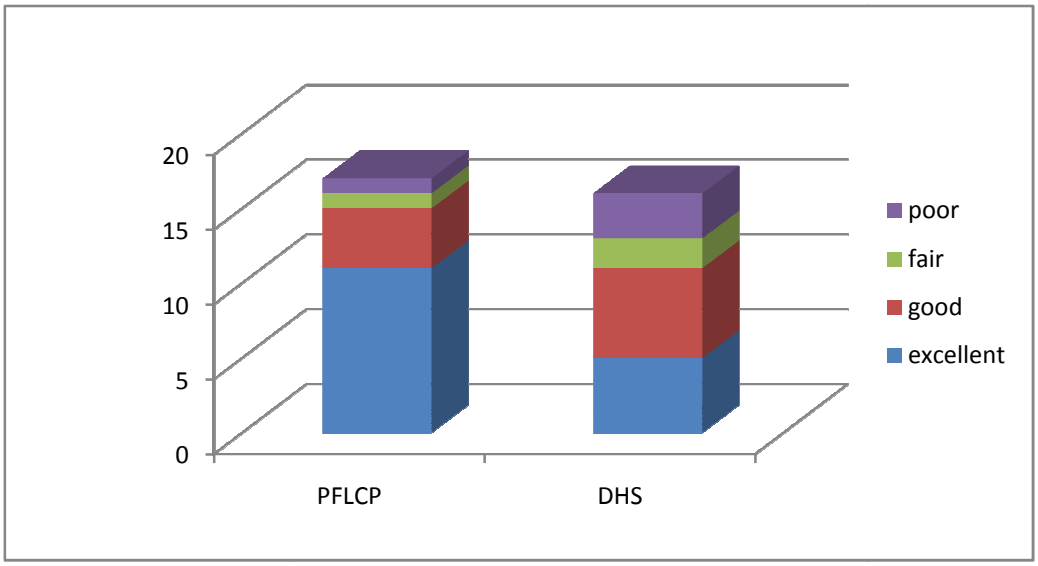
Range of motion score: Total Harris Hip score:
Readmission to hospital: Yes/No
Date of readmission: Implant removal date:

Based upon the above criterion the results of the study are as follows:

	PFLCP no. of patients(18)	**percentage**	**SHS no. of patients(16)**	**percentage**
Excellent	11	61.1%	3	18.75%
Good	5	22.2%	4	25%
Fair	1	5.5%	6	37.50%
Poor	1	5.5%	3	18.75%

ByYates corrected Chi - Square Test

$X^2 = 5.95$ P = 0.01



ILLUSTRATIVE CASES

CASE I:

vasudevan/45/male/I.P.NO:62015

Diagnosis: type IV IT # Lt.side

patient had a Harris Hip score of 92 at one year follow-up

PRE-OP X-RAY **IMMEDIATE POST-OP**

IMMEDIATE POST-OP LATERAL VIEW

3rd MONTH FOLLOW - UP

Squatting

Sitting With Cross - Legged Extension

CASE II

NISHA/31/female /i.p.no:11137

Diagnosis: Type III IT # Rt. side

patient had a Harris Hip score of 94 at 1 year follow-up.

PRE-OP

IMMEDIATE POST-OP

3rd month follow-up

6th month follow-up

9th month follow - up

SQUATTING

SITTING WITH CROSS - LEGGED EXTENSION

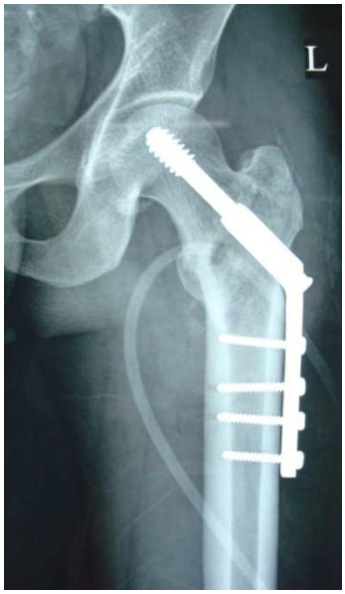
CASE III

Ibrahim/63/m/5535

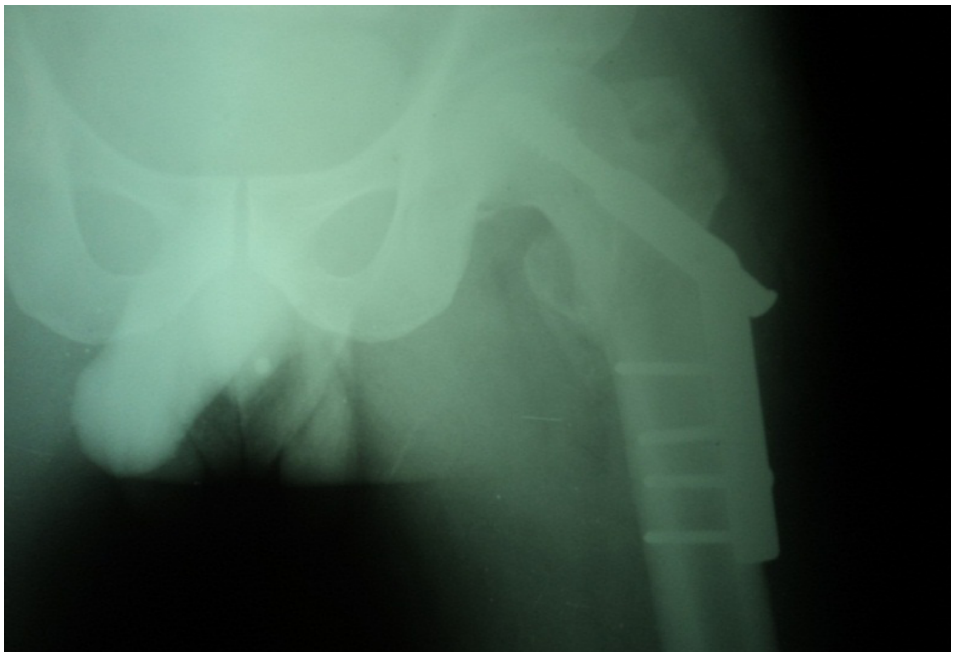
Diagnosis :Type II IT # Lt. side

patient had a Harris Hip score of 89 at 9th month follow-up

PRE-OP **IMMEDIATE POST- OP X-RAY AP& LATERAL VIEW**



9TH MONTHFOLLOW-UP POST-OP X-RAY



SQUATTING

SITTING WITH CROSS - LEGGED EXTENSION

CASE IV

KASI/67/M/17646

DIAGNOSIS**:**TYPE II IT **#** Rt**.** side

patient had a Harris-Hip scoreof 82 after9th follow - up

Pre-op

Immediate post-op

9th month follow-up

SQUATTING

SITTING WITH CROSS - LEGGED EXTENSION

ILLUSTRATION OF COMPLICATIONS

Ezhumalai/45/male/ip.no:17280

Diagnosis: Type IV IT# Rt. With screw cut-out

PRE-OP **POST-OP**

Pandian/68/m/58464

Diagnosis: Type III IT# Rt. with implant breakage

PRE-OP **POST- OP**

2nd month follow-up

Baby/55/f/68761

Diagnosis: Type III inter trochanteric fracture Rt. with varus collapse

PRE-OP **2ND MONTH FOLLOW-UP**

DISCUSSION

Trochanteric fracture unites readily due to adequate blood supply and its predominant spongy nature.

Causes non-union of inter trochanteric fracture are

- Excessive traction and movement causes distraction at the fracture site.
- soft tissue inter position
- systemic steroid therapy leading to advanced osteoporosis.
- pathological fracture
- excessive mobility at the fracture site
- infection

In the elderly patient, conservativetreatment leads to following complications they are:

- hypostatic pneumonia
- decubitus ulcers
- Retention of urine – decubitus calculi and urinary tract nfection
- Disuse osteoporosis
- Disuse atrophy of muscles
- Joint contracture and stiffness
- Deep vein thrombosis

To avoid above mentioned complications, it is advisable to undertake open reduction and internal fixation intertrochanteric fracture as early as possible.

For this two conditions must be met:

1) The fracture must be rendered stable in a suitable reduced position.

2) The implant must be strong enough to withhold tension on the fracture site during healing.

Agreement has been arrived on the significance of restoring stability and early mobilisation during the treatment of unstable intertrochanteric fractures. The morbidity and mortality rate associated with prolonged immobilisation has been reduced with successful restoration of stability and early mobilisation.

Kenzora et al. found on overall mortality rate of 15% in fractures about the hip compared to an expected mortality of 9% for the normal population. In hisstudy, significant factors were identified, like Patients over the age 70 had three times the mortality of younger patients. Greater than three pre-existing medical conditions were associated with a 25% mortality rate, more than twice that of healthier patients.

Larsson et al. studies show that excessive collapse, loss of fixation and cutting of the lag screw resulting in poor function are major problems

associated with internal fixation of unstable intertrochanteric fractures in elderly patients with osteoporotic bone.

The best treatment for these fractures remains controversial.Most of the currently available internal fixation devices can be expected to yield satisfactory results. Regardless of the device selected, fracture reduction and stability are most important factors.

Although SHS is one of the standard, accepted treatments,high failure rates of sliding hip screws in unstable fractures have been reported. The study by Saarenapaa et al[9].with the reoperation rate of 8.2% confirms it.

Yang YY[10] et al, reported that functional recovery of PFLCP was better than DHS, and complications are fewer than that of DHS and other Intramedullary fixation devices. LI Za et al, reported that comparing SHS, PFLCP has less blood loss and drainage, andshorter operative time with the significance between two groups of $P< 0.05$. Mitchell MS[14] et al, reported that the mean number of cycles to failure for the locking plate-screw construct was 2.6 times higher than that of conventional plate- screw construct ($P =0.016$) . So it would be particularly useful in unstable and osteoporotic fractures.

Failure of Proximal Femoral Locking Compression Plate-A case series byGlassner et al, convinced that the failure could be due to patient and technical factors and not due to the implant.

Erik A. Hasenbohler et al, reported axial and torsional stiffness testing along with cyclic axial loading to failure, the PFLCP provided higher axial stiffness than the blade plate with the advantage of less extensile approach to the fracture.

In our study, we found that treatment of unstable inter trochanteric fractures with PFLCP, could lower the complication compared with SHS with the statistical significance of 0.04 by Yates corrected Chi-Square test and this is comparable favourably with other studies (Zha GC[13] et al,Luo XP[11] et al, and Wang Y[10] et al). .

The Functional outcome evaluated by Harris hip score was betterin PFLCP group and it is statistically significant with P value of 0.01 and were regarded good in PFLCP group and fair in DHS group,which goes favourably with study by ChenZL et al[13].

CONCLUSION

Results of our study were comparable with already published reports of treatment of unstable intertrochanteric fractures with proximal femoral locking compression plate. From our study fractures treated with PFLCP hadbetter outcome than SHS. In ourstudy despite randomisation the PFLCP group had significantly younger individuals, which may have biased the outcome.

Though results were encouraging the experience was short. More clinical trials are needed to analyse the validity of PFLCP fixation in the treatment of unstable intertrochanteric fractures.

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PROFORMA

INTERNAL FIXATION OF UNSTABLE INTERTROCHANTERIC FRACTURES WITH SLIDINGHIPSCREW& LOCKING COMPRESSION PLATE – SHORT TERM PROSPECTIVE & COMPARATIVE ANALYSIS.

Case no : …….. Unit :……

Name : ……. Age /Sex :……..

I.P.no :……..... Occupation :……

Address : …….

…….

…….

……Phone :……

Date of injury : ……/……/……..

Date of admission : ……/……/……..

Date of surgery : ……/……/……..

Date of discharge : ……/……/……..

Mechanism of injury:

- ☐ Road traffic accident
- ☐ Accidental fall
- ☐ Industrial accident
- ☐ Assault others : ……..

Co-morbidities

☐	Diabetes	☐	TB
☐	Hypertension	☐	cardiovascular disease
☐	Asthma	☐	chronic renal failure

General condition :

- ☐ Conscious
- ☐ Drowsy
- ☐ Unconscious

Side involved :

- ☐ Right
- ☐ Left

X ray findings :

Type of fracture :

AO/OTA :

A1. Simple (2-fragment) per trochanteric area fractures:

- ☐ A1.1 Fractures along the intertrochanteric line;
- ☐ A1.2 Fractures through the greater trochanter;
- ☐ A1.3 Fractures below the lesser trochanter;

A2. Multi-fragmentary per trochanteric fractures;

- ☐ A2.1 With one intermediate fragment (lesser trochanter detachment);
- ☐ A2.2 With 2 intermediate fragments;
- ☐ A2.3 With more than 2 intermediate fragments;

A3. Intertrochanteric fractures;

- ☐ A3.1 Simple, oblique;
- ☐ A3.2 Simple, transverse;
- ☐ A3.3 With a medial fragment

Boyd &Griffin :

- ☐ Type 1
- ☐ Type 2
- ☐ Type 3
- ☐ Type 4

Associated other long bone injuries : (Yes/No)

If yes……

……

……

Associated head injury : (yes/ No)

Treatment history :

Treatment elsewhere if any :

……

……

……

Treatment in our institution :

Initial management :

……..

……..

……..

Time interval between initial management &

definitive fixation :……

Definitive procedure :

- ☐ Sliding hip screw
- ☐ Proximal femoral locking compression plate

Anaesthesia :

Operative notes :

……

……..

……..

……..

……..

……..

……

Blood transfusion : (yes/No)

Operating time :

Intraoperative events &difficulties :

……

……..

……..

Anaesthetic complications : (yes / No)

……

Amt of blood loss :

(diff in Hb conc. before & after surgery)

Duration of hospital stay :

Amount of Drain :

Post operative immobilization : ……

Limb length discrepancy :……..

Other injuries if any & their management :…….

……...

……..

Wound status

Drain removal after ……days

Suture removal after …… days

IV antibiotics …….days,

Pus C/s (if any): …….

……

Oral antibiotics ……days

Post-operative mobilization :

☐ Non weight bearing

☐ Partial weight bearing with walker

Post-operative complications:

☐ Pulmonary

☐ Urinary tract infections

☐ Deep vein thrombosis

☐ Cardiovascular complications

☐ Prosthesis / fixation failure

☐ Wound infection

☐ Pressure sores

Any other :……

……

follow up:

VISITS	DATE	WOUND STATUS	X-RAY	HARRIS HIP SCORE
6 Weeks				
3 Months				
6 Months				

Sr.No.	NAME	AGE	SEX	IP No.	DIAGNOSIS	PROCEDURE DONE	FOLLOW-UP(inmonths)	COMPLICATIONS	HARRISON HIP SCORE
1	Subramani	45	M	53799	Type IV IT # Rt	DHS		lost to follow-up	
2	Savithiri	75	F	54543	Type II IT # Rt	DHS	12		74
3	Purusothaman	34	M	54753	Type II IT # Lt	DHS	26		94
4	Nandagopal	70	M	55645	Type II IT # Lt	DHS	19		84
5	Lakshmanan	35	M	2184	Type IV IT # Rt	DHS	0	lost to follow-up	
6	Kasi	67	M	17646	Type II IT # Rt	DHS	14		82
7	Saroja	51	F	56374	Type III IT # Rt	DHS	21		76
8	Ibrahim	63	M	5535	Type II IT # Lt	DHS	16		89
9	Govindasamy	55	M	17310	Type II IT # Lt	DHS	14		91
10	Kannan	45	M	17280	Type IV IT # Rt	DHS	7	screw cut-out	0
11	Ekambaram	63	M	55213	Type II IT # Rt	DHS	9	deep infection	45
12	Chidambaram	39	M	56718	Type III IT # Lt	DHS	15		73
13	Kanniyammal	71	F	547382	Type III IT # Rt	DHS	17		74
14	Arokiyamary	59	F	57453	Type III IT # Rt	DHS	5	lost to follow-up	
15	Annamalai	67	M	54782	Type III IT # Lt	DHS	11		96
16	Jaya	70	F	58827	Type II IT # Rt	DHS	8		78
17	Pandian	68	M	58464	Type III IT # Rt	DHS	10	implant breakage	0
18	Akilandeswari	71	F	67356	Type III IT # Rt	DHS	9	lost to follow-up	
19	Pushpa	73	F	71523	Type III IT # Lt	DHS	18		85
20	Dhanalakshmi	54	F	72745	Type III IT # Rt	DHS	13		76
21	Murugiayan	56	M	367287	Type II IT # Lt	LCP	9	lost to follow-up	
22	Nisha	31	F	11137	Type III IT # Rt	LCP	11		94
23	Prathap	27	M	39782	Type III IT # Lt	LCP	16		93
24	Selvam	55	M	56298	Type II IT # Rt	LCP	6		84
25	Vasudevan	45	M	62015	Type IV IT # Lt	LCP	21	superficial infection	95
26	Vinodkumar	29	M	64735	Type III IT # Rt	LCP	18		96
27	Ravikumar	35	M	67423	Type III IT # Rt	LCP	14		92
28	kutty	38	m	61979	Type III IT # Lt	LCP	9		87
29	Baby	55	F	68761	Type III IT # Lt	LCP	22		91
30	Karuppusamy	55	M	65453	Type III IT # Rt	LCP	11	varus collapse	0
31	sabarinathan	36	M	74568	Type III IT # Rt	LCP	14		86
32	Manjula	48	F	56819	Type II IT # Rt	LCP	16		94
33	Perumal	68	M	71294	Type III IT # Rt	LCP	18		95
34	Pankanjammal	49	F	68251	Type II IT # Lt	LCP	7		81
35	Sivakumar	35	M	74378	Type IV IT # Rt	LCP	10		96
36	Munusamy	51	M	75498	Type II IT # Rt	LCP	9		75
37	Amanulla	52	M	67814	Type II IT # Lt	LCP	21		97
38	Venda	54	F	87326	Type III IT # Lt	LCP	17		87
39	Krishnaraj	49	M	83219	Type III IT # Rt	LCP	12		94
40	Nagammal	58	F	71563	Type II IT # Lt	LCP	16		92

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. C. Palanikumar
PG in MS Orthopaedics
Madras Medical College, Chennai -3

Dear Dr. C. Palanikumar

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "Internal fixation of unstable intertrochanteric fractures with dynamic hip screw and locking compression plate" No.28092012.

The following members of Ethics Committee were present in the meeting held on 13.09.2012 conducted at Madras Medical College, Chennai -3.

1. Dr. S.K. Rajan. M.D.,FRCP.,DSc	-- Chairperson
2. Prof. Pregna B. Dolia MD Vice Principal, Madras Medical College, Chennai -3 Director , Institute of Biochemistry, MMC, Ch-3	-- Member Secretary
3. Prof. B. Vasanthi MD Professor of Pharmacology ,MMC, Ch-3	-- Member
4. Prof. M. Reghu MD Director, Inst. Of Internal Medicine, MMC, Ch-3	-- Member
5. Prof. MD. Ali. MD.DM Prof & HOD of MGE, MMC, Ch-3	-- Member
6. Prof. P. Karkuzhali. MD Director i/c, Prof., Inst. of Pathology, MMC, Ch-3	-- Member
7. Prof. Bavani Shankar. MS Prof of General Surgery, MMC, Ch-3	-- Member
8. Thiru. S. Govindsamy. BABL	-- Lawyer
9. Tmt. Arnold Soulina MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

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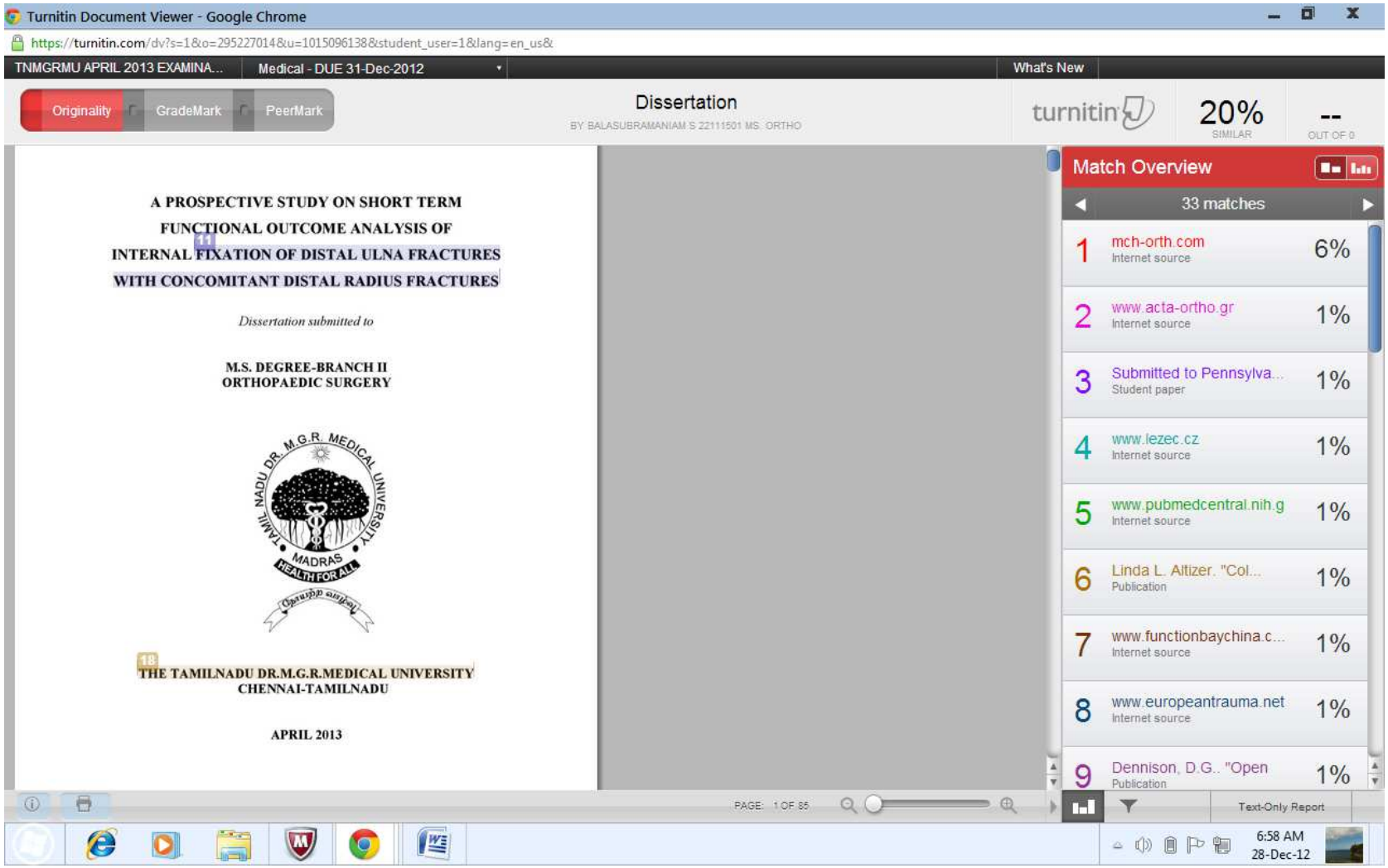
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